MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for December, 1898, is based on about 2,762 reports from stations occupied by regular and voluntary observers, classified as follows: 162 from Weather Bureau stations; numerous special river stations; 32 from post surgeons, received through the Surgeon General, United States Army; 2,385 from voluntary observers; 96 received through the Southern Pacific Railway Company; 29 from Life-Saving stations, received through the Superintendent United States Life-Saving Service; 31 from Canadian stations; 10 from Mexican stations; 7 from Jamaica, W. I. International simultaneous observations are received from a few stations and used, together with trustworthy newspaper extracts and special reports.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Meteorologist to the Hawaiian Government Survey, Honolulu; Dr. Mariano Bárcena, Director of the Central Meteorological and Magnetic Observatory of Mexico; Mr. Maxwell Hall, Government Meteorologist, Kingston, Jamaica; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; and Commander J. E. Craig, Hydrographer, United States Navy.

The REVIEW is prepared under the general editorial supervision of Prof. Cleveland Abbe.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to generally conform to the modern international system of standard meridians, one hour apart, beginning with Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local meridian is mentioned.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

But one storm of marked strength visited the Great Lakes and the Atlantic seaboard in December, 1898. This storm appeared over the west part of the Gulf of Mexico on the 2d and moved thence to the St. Lawrence Valley by the 5th, with wind velocities of 30 to 40 miles an hour along the middle and west coasts of the Gulf of Mexico on the 3d, and velocities of 40 to 60 miles an hour over the lower Lakes and along the middle Atlantic coast on the 4th. The highest wind velocity on record at the Weather Bureau office at New York city, 76 miles an hour from the east, was registered during the night of the 4th. During the 5th hard westerly gales continued along the middle Atlantic and New England coasts. Throughout its course the storm was attended by heavy precipitation, and in the lower Lake region and parts of New York and New England heavy snow, drifted by high winds, seriously interfered with traffic and telegraphic communication.

Action in distributing warnings in advance of the disturbance was taken by the Weather Bureau as follows: The morning of the 3d storm signals were ordered for the middle and west coasts of the Gulf of Mexico, and shipping interests in those sections were advised that a storm was central over Louisiana moving northeast, and were warned of high northwest winds and much colder weather. Especially dangerous features were not, however, developed during the 3d, but as an increase in intensity almost invariably attends the northward advance of storms of this class, close watch was kept upon its movements by means of special reports, and storm signals, based upon noon reports, were ordered on the Atlantic coast from Hatteras to Eastport. In the evening storm signals were ordered for the lower Lakes and the south Atlantic coast.

The morning of the 4th, when the storm was central over Kentucky, hurricane signals were ordered along the Atlantic coast from Cape May to Eastport by the following message:

Hoist hurricane signals at once. Northeast hurricane winds with heavy snow in New York and New England.

Hurricane signals were also ordered at all ports on Lakes Ontario and Erie, and at Detroit, Mich., with the information that heavy rain would turn to snow, and observers and displaymen were directed to hold all shipping in port.

These extreme warnings called for the greatest possible activity on the part of all employees of the Weather Bureau in the sections for which the signals and warnings were issued, and notice of the approaching storm and of its exceptional severity was given a most effective distribution among the maritime, commercial, and traffic interests, and, so far as possible, shipping was held in port.

Information contained in reports of observers and the daily press shows that a northeast gale of terrific force began over the lower Lakes the afternoon of the 4th. At Detroit high wind and heavy snow disabled the street car service. Managers of lines received ample warning but the snow was too heavy to be handled with the facilities at hand. All vessels in, and passing, that port were warned. Late in the afternoon telegraphic communication was cut off. At Cleveland the storm was reported the most severe of the season. The warning was heeded, and vessels and their cargoes, valued at upward of $800,000 were sheltered in that port. The observer states that a disregard of the warnings would have resulted in a loss of vessels and lives. Throughout the interior of New York the high wind and heavy snow which began on the 4th continued during the 5th, 6th, and 7th, delaying railroad traffic. Considerable damage by high wind was caused along the New Jersey coast. Many captains heeded the storm signals hoisted on the 3d, and upward of 100 steamers and sailing vessels sought refuge at Sandy Hook and Gravesend Bay. At Long Branch, Sunday night, the wind reached a velocity of 70 miles an hour from the east, and heavy seas carried away 160 feet of the iron pier. The signals kept many vessels in port at New York and other harbors of the north Atlantic coast, and in view of the exceptional severity of the storm many casualties were doubtless averted by the general regard given to the warnings.

COLD WAVE WARNINGS.

The first well-marked cold wave of the month appeared over the upper Missouri valley on the 12th; extended over the States of the upper Mississippi valley and the western Lake region during the 13th, carrying the line of zero temperature to southern Iowa, and reached the Atlantic and Gulf coasts on the 14th, with a minimum temperature of 30° at New Orleans, 28° at Mobile, 30° at Savannah, and 38° at Jacksonville. The second wide-spread cold wave of the month extended over the northern Rocky Mountain region and the upper Mississippi valley the night of the 28th, and reached the Atlantic coast and Gulf States on the 31st, with zero temperature to the southern line of Kansas, and freezing weather almost to the west Gulf coast. All sections and interests, likely to be injuriously affected, received prompt and ample notification of the approach of these cold waves.

CHICAGO FORECAST DISTRICT.

The abnormally cold weather which prevailed during the last nine days of November in the district continued with almost remarkable persistence until the middle of December. In Chicago during the entire period of twenty-four days there was but one day on which the temperature was above normal. This condition seriously affected the shipments of perishable goods, and shippers in Chicago and at other points were in daily communication with the Chicago office by telephone and otherwise. Each morning during the winter the probable minimum temperature at Chicago for the ensuing night is forecast, and both shippers and transportation companies find this to be of great value in the movement and protection of perishable produce. With the breaking up of the western high pressure area on the 14th instant, shippers were advised that less caution was necessary, and the period of comparatively mild weather for more than a week was advantageously used by them.

A well-marked cold wave developed in the Canadian Northwest during the night of December 28, and spread eastward and southward over the entire district during the 29th and 30th. Ample warning of its approach was given for all sections except a portion of the Rocky Mountain region, where its advent was very sudden.

During the portion of the month in which storm signals were displayed, but one storm occurred on the lakes which seriously affected navigation, that of December 4 on Lake Huron. This storm first appeared as an unimportant disturbance over the western Gulf States on December 1, and remained nearly stationary for forty-eight hours. On the 3d it began to move northeastward, increasing very much in intensity. On the morning of the 4th it was central over the middle Ohio Valley, and in the evening its center was over Pennsylvania. Heavy snow and severe gales accompanied the disturbance. Storm signal orders and warning messages were sent to Lakes Michigan and Huron ports on the afternoon and evening of the 3d. Warnings of heavy snow were also sent to the southeastern portion of Lower Michigan on the morning of December 4.—*H. J. Cox, Forecast Official.*

SAN FRANCISCO FORECAST DISTRICT.

On the evening of December 8, it was evident that a severe northeast gale would prevail during that night and the following day in portions of California. An effort was made to reach the chief wharfinger at 6 p. m., and notify him to advise all shipping in the harbor to take unusual precautions. The office was closed and the official could not be found. The warning was given to the Merchants' Exchange, the principal maritime body in the city, with a request to distribute it as far as possible. However, some vessels either failed to get the warning or failed to take the necessary precautions to prevent injury. The northeast storm signal was displayed on the following morning at San Francisco and points to the northward, and the information signal on the coast south of San Francisco. Probably the most severe northeast gale in the history of the State occurred during the 9th of December. The wind attained a velocity of 96 miles an hour at Point Reyes, and 44 miles at San Francisco. A lumber raft which was tied to the wharf at the north end of the city, went to pieces during the gale. The damage to shipping in the harbor, and to wharves, amounted to upward of $2,000. It would probably have been considerably more had not some precautions been taken.

On December 10 warning of a severe frost, probably injurious to citrus fruit, was distributed throughout California, which was verified in almost all portions of the State except southern California. Precautions were taken to reduce the damage to a minimum, and in the northern portion, where the most severe temperatures occurred, a large portion of the crop was picked and injury thus prevented, while in the southern portion the temperatures were not so severe but what the methods of protection resorted to were ample to prevent injury. Temperatures from 26° to 34° prevailed throughout the entire State except the extreme southwestern portion.

On December 13 the weather map showed conditions favorable for a storm in California and warnings of rain were distributed in the northern portion of the State. Prior to this storm one of the most severe periods of drought ever known in the history of California had prevailed. With the exception of two months of very light rainfall there had been a continued deficiency of rainfall for over twenty months, and the present season had progressed until near its middle with but little rainfall. The supply of feed and hay for stock had become exhausted throughout the entire southern portion of the State and stock had commenced to die from starvation. One large owner had just made arrangements to ship eighteen carloads of cattle from Monterey County to Nevada, and most extreme measures were being resorted to to prevent stock